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Special Issue on ENDF/B-VII.1 Library



# ENDF/B-VII.1 Nuclear Data for Science and Technology: Cross Sections, Covariances, Fission Product Yields and Decay Data

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## Abstract

The ENDF/B-VII.1 library is our latest recommended evaluated nuclear data file for use in nuclear science and technology applications, and incorporates advances made in the five years since the release of ENDF/B-VII.0. These advances focus on neutron cross sections, covariances, fission product yields and decay data, and represent work by the US Cross Section Evaluation Working Group (CSEWG) in nuclear data evaluation that utilizes developments in nuclear theory, modeling, simulation, and experiment.

The principal advances in the new library are: (1) An increase in the breadth of neutron reaction cross section coverage, extending from 393 nuclides to 423 nuclides; (2) Covariance uncertainty data for 190 of the most important nuclides, as documented in companion papers in this edition; (3) R-matrix analyses of neutron reactions on light nuclei, including isotopes of He, Li, and Be; (4) Resonance parameter analyses at lower energies and statistical high energy reactions for isotopes of Cl, K, Ti, V, Mn, Cr, Ni, Zr and W; (5) Modifications to thermal neutron reactions on fission products (isotopes of Mo, Tc, Rh, Ag, Cs, Nd, Sm, Eu) and neutron absorber materials (Cd, Gd); (6) Improved minor actinide evaluations for isotopes of U, Np, Pu, and Am (we are not making changes to the major actinides <sup>235,238</sup>U and <sup>239</sup>Pu at this point, except for delayed neutron data and covariances, and instead we intend to update them after a further period of research in experiment and theory), and our adoption of JENDL-4.0 evaluations for isotopes of Cm, Bk, Cf, Es, Fm, and some other minor actinides; (7) Fission energy release evaluations; (8) Fission product yield advances for fission-spectrum neutrons and 14 MeV neutrons incident on <sup>239</sup>Pu; and (9) A new decay data sublibrary.

Integral validation testing of the ENDF/B-VII.1 library is provided for a variety of quantities: For nuclear criticality, the VII.1 library maintains the generally-good performance seen for VII.0 for a wide range of MCNP simulations of criticality benchmarks, with improved performance coming from new structural material evaluations, especially for Ti, Mn, Cr, Zr and W. For Be we see some improvements although the fast assembly data appear to be mutually inconsistent. Actinide cross section updates are also assessed through comparisons of fission and capture reaction rate measurements in critical assemblies and fast reactors, and improvements are evident. Maxwellian-averaged capture cross sections at 30 keV are also provided for astrophysics applications.

We describe the cross section evaluations that have been updated for ENDF/B-VII.1 and

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Edited By Pavel Obložinský

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